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Docket No.: 5986/17686-US4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: John W. **BARNWELL**

Serial No.: 09/667,130 Art Unit: 1645

Filed: September 21, 2000 Examiner: P. Duffy

For: **PLASMODIUM VIVAX BLOOD STAGE ANTIGENS, ANTIBODIES AND DIAGNOSTIC ASSAYS**

October 17, 2000

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

DECLARATION OF DONALD CROTHERS

Considered 6/28/02 AM

I, Donald Crothers, declare and state as follows:

BACKGROUND

1. I, Dr. Donald Crothers, am currently the Sterling Professor of Chemistry and Professor of Molecular Biophysics and Biochemistry at Yale University in New Haven, Connecticut, and have been at the post since 1997. I was Chairman of the Chemistry Department at Yale University from 1993 to 1999. In addition, I was the Alfred E. Kemp

Professor of Chemistry at Yale University from 1985 through 1996, and I have been an Assistant Professor, Associate Professor, and Professor at Yale University since 1964. Throughout my over 36 year career at Yale University, I have published numerous articles and have taught many courses in the area of Biochemistry and Molecular Biology, as can be seen in my attached *curriculum vitae*. In particular, my research has focused on nucleic acids, which I have been informed is the subject matter of the present patent application.

2. I have been a member of various advisory and editorial boards for journals in the area of Biochemistry, Biophysics, and Molecular Biology, including the Journal of Molecular Biology (1971-1975); Nucleic Acids Research (1973-1982); and Biochemistry (197-1979). I have also served on committees such as the Visiting Committee for the Brookhaven National Laboratory Biology Department (1992-1997).

3. I am not a co-inventor of the present application, and I do not have a financial interest in the present application, nor in the outcome of the present proceedings. I also do not have a financial interest in New York University or in the Beckton Dickinson Corporation, which I have been informed have certain rights in this invention.

4. In preparation for my Declaration, I have reviewed in detail the specification for the present application, and *Southern*, Journal of Molecular Biology, 98:503 (November 1975) (hereinafter the "Southern publication").

5. My understanding of the invention as described in the specification is that the invention relates to isolated, purified polynucleotides encoding for a *Plasmodium vivax* protein or fragments thereof. It is my understanding that these proteins or protein fragments are to be used for the preparation of diagnostic assays for the detection and selective identification of *Plasmodium vivax* in liquid biological samples.

QUESTION CONSIDERED

6. In connection with my retention as an expert in the present application, I have been asked to consider the following question which I understand is relevant to the issue of patentability of the claims in the present application. The question is as follows:

(i) Whether as of June 2, 1993, a person of ordinary skill in the foregoing field would have recognized the hybridization conditions as disclosed in the Southern publication as stringent conditions.

CONCLUSION

7. I have reviewed the above question, and based on the materials provided to me, as well as my experience as a researcher, author, lecturer and peer review editor in the field of biochemistry, and in particular in the area of nucleic acids, I conclude that a person of ordinary skill in the art, at the relevant time, would have recognized that all of the hybridization conditions as set forth in the Southern publication are stringent hybridization conditions and that any set of the disclosed conditions would have resulted in selection of a hybrid between a nucleic acid of interest to an investigator and its complement.

8. My conclusion is based on examination of the experimental conditions explored and used in the Southern publication. Stringent hybridization is typically carried out at the temperature that maximizes the hybridization rate of the target duplex (and therefore minimizes improper hybrid formation). It is generally found that this temperature occurs about 20 degrees Celsius below the melting temperature of the hybrid duplex, typically 65°C in the SSC buffer

commonly used at that time. Southern used 65°C for hybridization in SSC, and showed that the rate was a maximum at 80°C in 6X SSC, as shown in Figure 5 of the Southern publication. As shown in Figure 6, 80°C was then chosen as the appropriate temperature for hybridization in 6X SSC, i.e. the temperature at which improper hybrid formation would be minimized at the higher salt concentration of 6X SSC. Both sets of conditions 65°C/1X SSC and 80°C/6X SSC are stringent conditions, and they would have been readily recognized as such by a person of ordinary skill in this field well prior to 1993. The conditions of 65°C and 2X SSC are also stringent. Southern states that the results under these conditions were the same as at 80°C and 6X SSC

A second important feature of stringent conditions is a wash period at the hybridization temperature. This process selectively removes the improper hybrids because they have a more rapid dissociation rate than the target duplex. This protocol was used by Southern, as described on page 508 of the Southern publication.

The fact that the Southern publication does not refer to these hybridization conditions as stringent conditions is not an indication of lack of stringency. Although the term was known in 1972 at the time of the Southern publication, it was not in common use until after 1975. Nevertheless, the concept of stringency (i.e., the concept that the intrinsic specificity of the hybridization reactions depends on the annealing conditions employed), was familiar to those of ordinary skill in the field. I am confident that, in 1993, a person of ordinary skill in the field would have recognized the hybridization conditions as disclosed in the Southern publication as what we would now call (and did call in 1993) stringent conditions.

9. Finally, I declare that all statements that I have made herein of my own knowledge are true, and that all statements that I have made herein on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

10/17/2000
Date

Donald M. Crothers
Donald Crothers

BIOGRAPHICAL SKETCH

Give the following information for the key personnel and consultants and collaborators. Begin with the principal investigator/program director. Photocopy this page for each person.

NAME	POSITION TITLE
Donald M. Crothers	Sterling Professor of Chemistry Professor of Molecular Biophysics & Biochemistry

EDUCATION *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY
Yale University, New Haven. CT	B.S.	1958	Chemistry
Cambridge University, Cambridge, U.K.	B.A.	1960	Biochemistry
U. California, San Diego, CA	Ph.D.	1963	Chemistry
Max-Planck-Institute, Göttingen, Germany	Postdoc	1964	Biophysics

RESEARCH AND/OR PROFESSIONAL EXPERIENCE: Concluding with present position, list, in chronological order, previous employment, experience, and honors. Key personnel include the principal investigator and any other individuals who participate in the scientific development or execution of the project. Key personnel typically will include all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a substantive way to the scientific development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

Professional Experience:

Yale University, Departments of Chemistry and Molecular Biophysics and Biochemistry

Assistant Professor	1964-1968
Associate Professor	1968-1971
Professor	1971-
Alfred E. Kemp Professor	1985-1996
Sterling Professor	1997-
Chairman of Chemistry	1975-1981; 1993-present

Ancillary Professional Positions:

Editorial Board, Journal of Molecular Biology	1971-1975
Editorial Board, Nucleic Acids Research	1973-1982
Advisory Board, Biopolymers	1973-
Editorial Board, Biochemistry	1975-1979
Biophysics Biophysical Chemistry B Study Section (NIH) (Chairman 1974-1976)	1972-1976
Co-Chairman, Nucleic Acids Gordon Conference	1975
Council Member, Biophysical Society	1979-1982
Publications Committee, Biophysical Society	1982-1985
Editorial Board, Ann. Rev. Phys. Chem.	1981-1985
Biophysics Review Committee, Swedish National Research Council	1982
Visiting Committee, Brookhaven National Laboratory Biology Dept.	1992-1997

Honors:

National Finalist, Westinghouse Science Talent Search	1954
Yale B.S. Summa cum Laude, with exceptional distinction in Chemistry	1958
Mellon Fellow at Clare College, Cambridge	1958-1960
Cambridge B.A. - Class I Honours	1960
NSF Postdoctoral Fellow	1963-1964
Sloan Foundation Fellow	1966
Yale Science and Engineering Award for Contributions to Basic and Applied Science	1977
Guggenheim Fellow	1978-1979
Alexander von Humbolt U.S. Senior Scientist Award	1981
Fellow, American Academy of Arts and Sciences	1986
Member, National Academy of Sciences	1987

Fellow, American Association for the Advancement of Science 1992

Recent Publications:

229. Determinants of RNA Hairpin Loop-Loop Complex Stability, R. S. Gregorian and D. M. Crothers, *J. Mol. Biol.* **248**, 968-984 (1995).
230. Bent Helix Formation Between RNA Hairpins with Complementary Loops, J. P. Marino, R. S. Gregorian, G. Csankovszki and D. M. Crothers, *Science* **268**, 1448-1454 (1995).
231. Interaction of Human Immunodeficiency Virus Type 1 Tat-Derived Peptides with TAR RNA, K. S. Long and D. M. Crothers, *Biochemistry* **34**, 8885-8895 (1995).
232. In Vivo Structural Analysis of Spliced Leader RNAs in *Trypanosoma brucei* and *Leptomonas collosoma*: A Flexible Structure that Is Independent of Cap4 Methylations, K. A. Harris, Jr., D. M. Crothers and E. Ullu, *RNA* **1**, 351-362 (1995).
233. Determining RNA Solution Structure by Segmental Isotopic Labeling and NMR: Applications to *Caenorhabditis elegans* Spliced Leader RNA 1, J. Xu, J. Lapham and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 44-48 (1996).
234. Fos and Jun Do Not Bend the AP-1 Recognition Site, A. Sitlani and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 3248-3252 (1996).
235. RNase H Cleavage for Processing of in vitro Transcribed RNA for NMR Studies and RNA Ligation, J. Lapham and D. M. Crothers, *RNA* **2**, 289-296 (1996).
236. Prediction of the Stability of DNA Triplexes, R. W. Roberts and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 4329-4325 (1996). 237. Kinetic Discrimination in the Folding of Intramolecular Triple Helices, R. W. Roberts and D. M. Crothers, *J. Mol. Biol.* **260**, 135-146 (1996).
237. Kinetic Discrimination in the Folding of Intramolecular Triple Helices, R. W. Roberts and D. M. Crothers, *J. Mol. Biol.* **260**, 135-146 (1996).
238. Synthesis and Preliminary DNA Binding Study of Hybrids of the Carbohydrate Domain of Calicheamicin γ_1^I and the Aglycone of Daunorubicin: Calichearubicins A and B, K. M. Depew, S. M. Zeman, S. H. Boyer, D. J. Denhart, N. Ikemoto, S. J. Danishefsky and D. M. Crothers, *Angew. Chem. Int. Ed. Engl.* **35**, 2797 - 2801 (1996).
239. Identification and Characterization of Genomic Nucleosome-positioning Sequences, H. R. Widlund, H. Cao, S. Simonsson, E. Magnusson, T. Simonsson. P. E. Nielsen, J. D. Kahn, D. M. Crothers and M. Kubista, *J. Mol. Biol.* **267**, 807-818 (1997).
240. The Position of Site-Directed Cleavage of RNA using RNase H and 2'-O-methyl Oligonucleotides is Dependent on the Enzyme Source, J. Lapham, Y.-T. Yu, M.-D. Shu, J. A. Steitz, and D. M. Crothers, *RNA* **3**, 950-951 (1997).
241. Measurement of Diffusion Constants for Nucleic Acids by NMR, J. Lapham, J. P. Rife, P. B. Moore, and D. M. Crothers, *J. Biomolec. NMR* **10**, 255-262 (1997).
242. DNA-Binding Domains of Fos and Jun Do Not Induce DNA Curvature: An Investigation with Solution and Gel Methods, A. Sitlani and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 1404-1409 (1998).
243. Characterization of the ATF /CREB Site and Its Complex with GCN4, S. C. Hockings, J. D. Kahn, and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 1410-1415 (1998).
244. Measurement of the DNA Bend Angle Induced by the Catabolite Activator Protein Using Monte Carlo Simulation of Cyclization Kinetics, J. D. Kahn and D. M. Crothers, *J. Mol. Biol.* **276**, 287-309 (1998).
245. Simultaneous Determination of Helical Unwinding Angles and Intrinsic Association Constants in Ligand-DNA Complexes: The Interaction between DNA and Calichearubicin B, S. M. Zeman, K. M. Depew, S. J. Danishefsky and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 4327-4332 (1998).
246. The Solution Structure of an RNA Loop-Loop Complex: The *ColE1* Inverted Loop Sequence, A. J. Lee and D. M. Crothers, *Structure* **6**, 993-1005 (1998).
247. Characterization of Covalent Adriamycin-DNA Adducts, S. M. Zeman, D. R. Phillips and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 11561-11565 (1998).
248. An *In Vitro* Transcription Assay for Probing Drug-DNA Interactions at Individual Drug Sites, D. R. Phillips, C. M. Cullinane and D. M. Crothers, *Molecular Biotechnology* **10**, 63-75 (1998).
249. DNA Curvature and Deformation in Protein-DNA Complexes: A Step in the Right Direction (Commentary), *Proc. Natl. Acad. Sci. U.S.A.* **95**, 15163-15165 (1998).
250. Decreased Imino Proton Exchange and Base-pair Opening in the IHF-DNA Complex Measured by NMR, G. M. Dhavan, J. Lapham, S. Yang and D. M. Crothers, *J. Mol. Biol.* **288**, 659-671 (1999).
251. Characterization of the Solution Conformations of Unbound and Tat Peptide-Bound Forms of HIV-1 TAR RNA, K. S. Long and D. M. Crothers, *Biochemistry* **38**, 10059-10069 (1999).
252. Interaction of Calicheamicin γ_1^I and its Related Carbohydrates with DNA-Protein Complexes, C. Sissi, J. Aiyar, S. Boyer, K. Depew, S. Danishefsky and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **96**, 10643-10648 (1999).
253. DNA Bending by Adenine-Thymine Tracts, D. M. Crothers and Z. Shakked, *Oxford Handbook of Nucleic Acid Structures*, Ed. S. Neidle, Oxford University Press, Oxford (1999).
254. Site-Specific Cleavage of Transcript RNA, J. Lapham and D. M. Crothers, *Methods in Enzymology* **317**, 132-139 (2000).
255. On the Kinetics of Distamycin Binding to its Target Sites on Duplex DNA, R. Baliga and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **97**, 7814-7818 (2000).

BIBLIOGRAPHY

Donald M. Crothers

1. Simplified Rotating Cylinder Viscometer for DNA, B. H. Zimm and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **48**, 905 (1962).

2. A Phage Infecting Saprospira Grandis, R. A. Lewin, D. M. Crothers, D. L. Correll and B. F. Reimann, *Canadian J. of Microbiology* **10**, 75 (1964).

3. Interpretation of the Kinetics of Helix Formation, N. R. Kallenbach, D. M. Crothers and R. G. Mortimer, *Biochem. Biophys. Res. Comm.* **11**, 213 (1963).

4. Theory of the Melting Transition of Synthetic Polynucleotides: Evaluation of the Stacking Free Energy, D. M. Crothers and B. H. Zimm, *J. Mol. Biol.* **9**, 1 (1964).

5. The Kinetics of DNA Denaturation, D. M. Crothers, *J. Mol. Biol.* **9**, 712 (1964).

6. Viscosity and Sedimentation of the DNA from Bacteriophages T2 and T7 and the Relation to Molecular Weight, D. M. Crothers and B. H. Zimm, *J. Mol. Biol.* **12**, 525 (1965).

7. The Melting Transition of Low Molecular Weight DNA: Theory and Experiment, D. M. Crothers, N. R. Kallenbach and B. H. Zimm, *J. Mol. Biol.* **11**, 802 (1965).

8. Zur Kinetik der DNS-Denaturierung, D. M. Crothers, *Ber. Bunsenges. Physik. Chem.* **68**, 840 (1964).

9. On the Helix-Coil Transition in Heterogeneous Polymers, D. M. Crothers and N. R. Kallenbach, *J. Chem. Phys.* **45**, 917 (1966).

10. Theory of Thermal Transitions in Cohered DNA from Phage Lamda, N. R. Kallenbach and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **56**, 1018 (1966).

11. On the Form of the Partition Function for the Helix-Coil Transition of Heterogeneous Polymers, *Biopolymers* **4**, 1025 (1966).

12. Structure and Structural Transformations of Nucleic Acids, D. M. Crothers, in "*The Neurosciences*" **67**, Rockefeller University Press, New York (1967).

13. Calculation of Kinetic Curves for the Helix-Coil Transition of Polypeptides, Mary E. Craig and D. M. Crothers, *Biopolymers* **6**, 385 (1968).

14. Studies Concerning the Behavior of Actinomycin in Solution, D. M. Crothers, S. L. Sabol, D. I. Ratner and W. Muller, *Biochemistry* **7**, 1817 (1968).

15. Thermodynamic Studies of a Model System for Hydrophobic Bonding, D. M. Crothers and D. I. Ratner, *Biochemistry* **7**, 1823 (1968).

16. Calculation of Binding Isotherms for Heterogeneous Polymers, D. M. Crothers, *Biopolymers* **6**, 575 (1968).

17. Comparison of Several Calculations of Helix-Coil Transitions in Heterogeneous Polymers, T. R. Fink and D. M. Crothers, *Biopolymers* **6**, 863 (1968).

18. Studies of the Binding of Actinomycin and Related Compounds to DNA, W. Muller and D. M. Crothers, *J. Mol. Biol.* **35**, 251 (1968).

19. Calculation of Melting Curves for DNA, D. M. Crothers, *Biopolymers* **6**, 1391 (1968).

20. Appendix: Steady-State Kinetics of Double Helix Formation, D. M. Crothers, N. Davidson and N. R. Kallenbach, *J. Am. Chem. Soc.* **90**, 3560 (1968).

21. Relaxation Studies of the Proflavine-DNA Complex: The Kinetics of an Intercalation Reaction, H. J. Li and D. M. Crothers, *J. Mol. Biol.* **39**, 461 (1969).

22. Computation of Molecular Weight Averages for DNA Molecules Containing Both Preformed and Randomly Induced Single-Strand Breaks, D. M. Crothers, H.-CH. Spatz and E. Elson, *Biopolymers* **7**, 215 (1969).

23. The Rate of DNA Unwinding, H.-CH. Spatz and D. M. Crothers, *J. Mol. Biol.* **42**, 191 (1969).

24. On the Mechanism of Deoxyribonucleic Acid Unwinding, D. M. Crothers, *Acts. Chem. Res.* **2**, 225 (1969).

25. The Preparation, Preservation, and Properties of High Molecular Weight Polyadenylic Acid, D. W. Hennage, D. M. Crothers and D. B. Ludlum, *Biochemistry* **8**, 2298 (1969).

26. Studies of the Optical Properties of the Proflavine-DNA Complex, H. J. Li and D. M. Crothers, *Biopolymers* **8**, 217 (1969).

27. Preparation and Characterization of Monodisperse, Crosslinked Low Molecular Weight DNA, R. J. Cohen and D. M. Crothers, *Biochemistry* **9**, 2533 (1970).

28. Kinetic and Hydrodynamic Studies of the Complex of Proflavine with Poly A.Poly U, D. E. V. Schmechel and D. M. Crothers, *Biopolymers* **10**, 465 (1971).

29. Temperature Jump Methods, D. M. Crothers, in "*Procedures in Nucleic Acid Research*", ed. Cantoni and Davies, Harper and Row (1971).

30. Theory of the Influence of Oligonucleotide Chain Conformation on Double Helix Stability, C. DeLisi and D. M. Crothers, *Biopolymers* **10**, 1809 (1971).

31. *The Physical Chemistry of Nucleic Acids*, V. Bloomfield, D. M. Crothers and I. Tinoco, Jr., Harper and Row, New York (1974).

32. Kinetics of Binding Drugs to DNA, D. M. Crothers, *Progress in Molecular and Subcellular Biology* **2**, 10 (1971).

33. Kinetics of Complex Formation by Nucleic Acids, D. M. Crothers, *Studia Biophysica* 24/25, **79** (1970).

34. Sterische und Elektronische Effekte bei der Bindung von Acridinen und Ahnlichen Ringsystemen an DNS, W. Muller and D. M. Crothers, *Studia Biophysica* 24/25, **279** (1970).

35. Theory of Friction-Limited DNA Unwinding, D. M. Crothers and H. C. Spatz, *Biopolymers* **10**, 1949 (1971).

36. A Proton Magnetic Resonance Study of Single-Stranded and Double-Helical Deoxyribooligonucleotides, A. D. Cross and D. M. Crothers, *Biochemistry* **10**, 4015 (1971).

37. Prediction of RNA Secondary Structure, C. DeLisi and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **68**, 2682 (1971).

38. Statistical Thermodynamics of Nucleic Acid Melting Transitions with Coupled Binding Equilibria, D. M. Crothers, *Biopolymers* **10**, 2147 (1971).

39. Electrostatic Contributions to Oligonucleotide Transitions, C. DeLisi and D. M. Crothers, *Biopolymers* **10**, 2323 (1971).

40. Rate of Unwinding Small DNA, R. J. Cohen and D. M. Crothers, *J. Mol. Biol.* **61**, 525 (1971).

41. Relaxation Kinetics of Dimer Formation by Self Complementary Oligonucleotides, M. E. Craig, D. M. Crothers and P. Doty, *J. Mol Biol.* **62**, 383 (1971).

42. Local Effects of Partial Adenine-N1-Oxidation on Poly A·Poly U and Poly A·2 Poly U Helix Conformations, T. R. Fink and D. M. Crothers, *Biopolymers* **11**, 127 (1972).

43. The Influence of Polyvalency on the Binding Properties of Antibodies, D. M. Crothers and H. Metzger, *Immunochemistry* **9**, 341 (1972).

44. Free Energy of Imperfect Nucleic Acid Helices. I. The Bulge Defect, T. R. Fink and D. M. Crothers, *J. Mol. Biol.* **66**, 1 (1972).

45. Properties of a Dimer of $tRNA_I^{Tyr}$ (*Escherichia coli*), S. K. Yang, D. G. Soll and D. M. Crothers, *Biochemistry* **11**, 2311 (1972).

46. Is There a Discriminator Site in Transfer RNA?, D. M. Crothers, T. Seno and D. G. Soll, *Proc. Natl. Acad. Sci., USA* **69**, 3063 (1972).

47. Conformational Changes of Transfer Ribonucleic Acid. Equilibrium Phase Diagrams, P. E. Cole, S. K. Yang and D. M. Crothers, *Biochemistry* **11**, 4358 (1972).

48. Conformational Changes of Transfer Ribonucleic Acid. Relaxation Kinetics of the Early Melting Transition of Methionine Transfer Ribonucleic Acid (*Escherichia coli*), P. E. Cole and D. M. Crothers, *Biochemistry* **11**, 4368 (1972).

49. Conformational Changes of Transfer Ribonucleic Acid. Comparison of the Early Melting Transition of Two Tyrosine-Specific Transfer Ribonucleic Acids, S. K. Yang and D. M. Crothers, Biochemistry 11, 4375 (1972).

50. Free Energy of Imperfect Nucleic Acid Helices. II. Small Hairpin Loops, J. Gralla and D. M. Crothers, *J. Mol. Biol.* **73**, 497 (1973).

51. Free Energy of Imperfect Nucleic Acid Helices. III. Small Internal Loops Resulting from Mismatches, J. Gralla and D. M. Crothers, *J. Mol. Biol.* **78**, 301 (1973).

52. The Contribution of Proximity and Orientation to Catalytic Reaction Rates, C. DeLisi and D. M. Crothers, *Biopolymers* **12**, 1689-1704 (1973).

53. Nuclear Magnetic Resonance Study of Hydrogen-Bonded Ring Protons in Watson-Crick Base Pairs, D. M. Crothers, C. W. Hilbers and R. G. Shulman, *Proc. Natl. Acad. Sci., USA* **70**, 2899 (1973).

54. A Non-Intercalating Proflavine Derivative, W. Muller, D. M. Crothers and M. J. Waring, *Eur. J. Biochem.* **39**, 223 (1973).

55. Improved Estimation of Secondary Structure in Ribonucleic Acids, I. Tinoco, Jr., P. N. Borer, B. Dengler, M. D. Levine, O. C. Uhlenbeck, D. M. Crothers and J. Gralla, *Nature New Biology* **246**, 40-41 (1973).

56. Thermodynamic and Kinetic Properties of Short RNA Helices: The Oligomer Sequence A_nGCU_n, J. Ravetch, J. Gralla and D. M. Crothers, *Nuc. Acids Res.* **1**, 109 (1974).

57. Origins of Base Specificity in Actinomycin and Other DNA Ligands, D. M. Crothers and W. Muller, *Cancer Chemother. Rep.* **58**, 97-100 (1974).

58. Direct Physical Evidence for Secondary Structure in an Isolated Fragment of R17 Bacteriophage mRNA, J. Gralla, J. A. Steitz and D. M. Crothers, *Nature* **248**, 204-208 (1974).

59. Conformational Changes of Transfer Ribonucleic Acid. The pH Phase Diagram under Acidic Conditions, M. Bina-Stein and D. M. Crothers, *Biochemistry* **13**, 2771 (1974).

60. The Molecular Mechanism of Thermal Unfolding of Transfer RNA, D. M. Crothers, P. E. Cole, C. W. Hilbers and R. G. Shulman, *J. Mol. Biol.* **87**, 63-88 (1974).

61. *Functional Linkage in Biomolecular Systems*, D. M. Schneider, D. M. Crothers and F. O. Schmitt eds., Raven Press, New York (1975).

62. The Influence of Heteroatoms and Polarizability on the Base Specificity of Intercalating Ligands, W. Muller and D. M. Crothers, *Eur. J. Biochem.* **54**, 267-277 (1975).

63. Binding Kinetics of Mercury (II) to Polynucleotides, M. N. Williams and D. M. Crothers, *Biochemistry* **14**, 1944-1951 (1975).

64. Ethidium Reaction Kinetics: Demonstration of Direct Ligand Transfer between DNA Binding Sites, J. L. Bresloff and D. M. Crothers, *J. Mol. Biol.* **95**, 103-123 (1975).

65. Localization of the Structural Change Induced in $tRNA^{fMet}$ *Escherichia coli* by Acidic pH, M. Bina-Stein and D. M. Crothers, *Biochemistry* **14**, 4185 (1975).

66. RNA Structure and Structural Changes, D. M. Crothers, in "*Structure and Conformation of Nucleic Acids and Protein-Nucleic Acid Interactions*" 215-221, ed. M. Sundaralingam and S. T. Rao, University Park Press, Baltimore, Maryland (1975).

67. Equilibrium Binding of Mg(II) by E. coli $tRNA^{fMet}$, A. Stein and D. M. Crothers, *Biochemistry* **15**, 157-160 (1976).

68. Conformational Changes of tRNA. The role of Mg(II), A. Stein and D. M. Crothers, *Biochemistry* **15**, 160-168 (1976).

69. Studies of the Complex between Transfer RNA Molecules and Complementary Anticodons: Kinetic and Thermodynamic Aspects, H. Grosjean, D. Soll and D. M. Crothers, *Arch. Int. de Physiol. et de Biochimie* **83**, 970-971 (1975).

70. Studies of the Complex between Transfer RNAs with Complementary Anticodons. I. Origins of Enhanced Affinity between Complementary Triplets, H. Grosjean, D. G. Soll and D. M. Crothers, *J. Mol. Biol.* **103**, 499-519 (1976).

71. Studies of the Complex between transfer RNAs with Complementary Anticodons: Origins of Enhanced Affinity between Complementary Triplets, H. Grosjean, D. Soll and D. M. Crothers, *Arch. Int. de Physiol. et de Biochimie* **84**, 163-164 (1976).

72. Physical Studies of Denatured $tRNA_2^{Glu}$, M. Bina-Stein, D. M. Crothers and R. G. Shulman, *Proc. Natl. Acad. Sci., USA* **73**, 2216-2220 (1976).

73. Phase Partition Studies of Actinomycin - Nucleotide Complexes, P. Davanloo and D. M. Crothers, *Biochemistry* **15**, 4433-4438 (1976).

74. Physical Characterization of a Ribosomal Nucleoprotein Complex, T. R. Tritton and D. M. Crothers, *Biochemistry* **15**, 4377-4385 (1976).

75. Kinetic Studies of Drug-Dinucleotide Complexes, P. Davanloo and D. M. Crothers, *Biochemistry* **15**, 5299-5304 (1976).

76. Does 5S RNA Function by a Switch between Two Secondary Structures?, H. Weidner, R. Yuan and D. M. Crothers, *Nature* **266**, 193-194 (1977.)

77. An Ethidium-Induced Double Helix of poly(dA)·poly(rU), E. A. Lehrman and D. M. Crothers, *Nuc. Acids Res.* **4**, 1381-1393 (1977).

78. Influence of the A15 Mutation on the Conformational Energy Balance in *E. coli* $tRNA^{Tyr}$, V. Leon, S. Altman and D. M. Crothers, *J.Mol. Biol.* **113**, 253-265 (1977).

79. Studies of the Complex between tRNAs with Complementary Anticodons: A Direct Approach to the "Wobble" Problem, H. Grosjean, D. Soll and D. M. Crothers, *Arch. Int. de Physiol. et de Biochimie* **85**, 414 (1977).

80. Pathway-Dependent Refolding of E. Coli 5S rRNA, H. Weidner and D. M. Crothers, *Nuc. Acids Res.* **4**, 3401-3414 (1977).

81. Isolation and Characterization of a Spacerless Dinucleosome from H1-Depleted Chromatin, L. Klevan and D. M. Crothers, *Nuc. Acids Res.* **4**, 4077-4089 (1977).

82. Preparative Separation of the Complementaty Strands of DNA Restriction Fragments by Alkaline RPC-5 Chromatography, H. Eshaghpour and D. M. Crothers, *Nuc. Acids Res.* **5**, 13-21 (1978).

83. Transient Electric Dichroism of Rod-Like DNA Molecules, M. Hogan, N. Dattagupta and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **75**, 195-199 (1978).

84. On the physical Basis for Ambiguity in Genetic Coding Interactions, H. J. Grosjean, S. de Henau and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **75**, 610 (1978).

85. Electric Dichroism Studies of the Size and Shape of Nucleosomal Particles, L. Klevan, M. Hogan, N. Dattagupta and D. M. Crothers, *Cold Spring Harbor Symp. Quant. Biol.* **42**, 207-214 (1978).

86. Simplified Methods for Large Scale Enzymatic Synthesis of Oligoribonucleotides, B. Shum and D. M. Crothers, *Nuc. Acids Res.* **5**, 2297-2311 (1978).

87 .Does Irehdiamine Kink DNA?, N. Dattagupta, M. Hogan and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **75**, 4286-4290 (1978).

88. Transient Electric Dichroism Studies of Nucleosomal Particles, D. M. Crothers, N. Dattagupta, M. Hogan, L. Klevan and K. S. Lee, *Biochemistry* **17**, 4525-4533 (1978).

89. Physical Studies of Nuclesome Assembly, L. Klevan, N. Dattagupta, M. Hogan and D. M. Crothers, *Biochemistry* **17**, 4533-4540 (1978).

90. Conformational Changes of tRNA, D. M. Crothers and P. E. Cole, in *Transfer RNA*, ed. S. Altman, MIT Press, Cambridge, Mass., 196-247 (1978).

91. Transient Electric Dichroism Studies of the Structure of the DNA Complex with Intercalated Drugs, M. Hogan, N. Dattagupta and D. M. Crothers, *Biochemistry* **18**, 280-288 (1979).

92. ^{31}P NMR Spin-Lattice Relaxation Studies of Deoxyoligonucleotides, P. Davanloo, I. M. Armitage and D. M. Crothers, *Biopolymers* **18**, 663-680 (1979).

93. Transmission of Allosteric Effects in DNA, M. Hogan, N. Dattagupta and D. M. Crothers, *Nature* **278**, 521-524 (1979).

94. High-Resolution NMR of Exchangeable Protons in Arginine, Oligoarginine, and the Arginine-Rich Histone Tetramer, L. Klevan and D. M. Crothers, *Biopolymers* **18**, 1029-1044 (1979).

95. ^{31}P NMR Studies of the Solution Structure and Dynamics of Nucleosomes and DNA, L. Klevan, I. M. Armitage and D. M.Crothers, *Nuc. Acids Res.* **6**, 1607-1616 (1979).

96. *Physical Chemistry with Applications to the Life Sciences*, D. Eisenberg and D. M. Crothers, Benjamin/Cummings, Inc., Menlo Park, Calif. (1979).

97. Structural Changes of Nucleosomes in Low Salt Concentrations, H.-M. Wu, N. Dattagupta, M. Hogan and D. M. Crothers, *Biochemistry* **18**, 3960-3965 (1979).

98. NMR Investigation of Lysine-Oligopeptides and a Complex with d(pA)$_3$pGpC(pT)$_3$, P. Davanloo and D. M. Crothers, *Biopolymers* **18**, 2213-2231 (1979).

99. Analysis of RNA Secondary Structure by Photochemical Reversal of Psoralen Crosslinks, D. Rabin and D. M. Crothers, *Nuc. Acids Res.* **7**, 689-703 (1979).

100. Specific Chemical Labeling of DNA Fragments, H. Eshaghpour, D. Soll and D. M. Crothers, *Nuc. Acids Res.* **7**, 1485-1495 (1979).

101. DNA Structure and its Distortion by Drugs, D. M. Crothers, N. Dattagupta and M. Hogan, in "*Stereodynamics of Molecular Systems*" 383-396, R. H. Sarma, ed., Pergamon Press, New York (1979).

102. The 3' Terminus of 16S RNA: Secondary Structure and Interaction with Ribosomal Protein S1, R. C. Yuan, J. A. Steitz, P. B. Moore and D. M. Crothers, *Nuc. Acids Res.* **7**, 2399-2418 (1979.)

103. Selective Repression of Transcription by Base Sequence Specific Synthetic Polymers, L. D. Kosturko, N. Dattagupta and D. M. Crothers, *Biochemistry* **18**, 5751-5756 (1979).

104. Physical Studies of tRNA in Solution, D. M. Crothers, in "*Transfer RNA: Structure, Properties and Recognition*" 163-176, P. R. Schimmel, D. Soll and J. N. Abelson, eds., Cold Spring Harbor Laboratory (1979).

105. Unfolding of Nucleosomes by Ethidium Binding, H.-M. Wu, N. Dattagupta, M. Hogan and D. M. Crothers, *Biochemistry* **19**, 626-634 (1980).

106. Singlet-Singlet Energy Transfer Studies of the Internal Organization of Nucleosomes, H. Eshaghpour, A. E. Dieterich, C. R. Cantor and D. M. Crothers, *Biochemistry* **19**, 1797-1805 (1980).

107. Effect of DNA Length on the Nucleosome Low Salt Transition, A. E. Dieterich, H. Eshaghpour, D. M. Crothers and C. R. Cantor, *Nuc. Acids Res.* **8**, 2475-2487 (1980).

108. A proton-coupled conformational switch of Escherichia coli 5S ribosomal RNA, T. H. Kao and D. M. Crothers, *Proc. Natl. Acad. Sci., U.S.A.* **77**, 3360-3364 (1980).

109. Interaction of Netropsin and Distamycin with DNA: Electric Dichroism Study. N. Dattagupta, M. Hogan and D. M. Crothers, *Biochemistry* **19**, 5998-6005 (1980).

110. Solution Structural Studies of Chromatin Fibers. K. S. Lee, M. Mandelkern, and D. M. Crothers, *Biochemistry* **20**, 1438-1445 (1981).

111. Equilibrium Studies of Ethidium-Polynucleotide Interactions. J. L. Breslоff and D. M. Crothers, *Biochemistry* **20**, 3547-3553 (1981).

112. Solution Structural Studies of the Ag(I)-DNA Complex. N. Dattagupta and D. M. Crothers, *Nuc. Acids Res.* **9**, 2971-2985 (1981).

113. Conversion of B DNA Between Solution and Fiber Conformations. M. Mandelkern, N. Dattagupta and D. M. Crothers, *Proc. Nat. Acad. Sci., U.S.A.* **78**, 4294-4298 (1981).

114. The Dimensions of DNA in Solution. M. Mandelkern, J. G. Elias, D. Eden and D. M. Crothers, *J. Mol. Biol.* **152**, 153-161 (1981).

115. Solution Structural Studies of the A and Z Forms of DNA. H.-M. Wu, N. Dattagupta and D. M. Crothers, *Proc. Nat. Acad. Sci., U.S.A.* **78**, 6808-6811 (1981).

116. Equilibria and Kinetics of lac Repressor-Operator Interactions by Polyacrylamide Gel Electrophoresis. M. Fried and D. M. Crothers, *Nuc. Acids Res.* **9**, 6505-6525 (1981).

117. Influence of Ionic Strength on the Dichroism Properties of Polynucleosomal Fibers. K. S. Lee and D. M. Crothers, *Biopolymers* **21**, 110-116 (1982).

118. Unfolding of 175 bp Nucleosomes, F. B. Schlessinger, N. Dattagupta and D. M. Crothers, *Biochemistry* **21**, 664-669 (1982).

119. Self-Association of Daunomycin, J. B. Chaires, N. Dattagupta and D. M. Crothers, *Biochemistry* **21**, 3927-3932 (1982).

120. Studies on Interaction of Anthracycline Antibiotics and Deoxyribonucleic Acid: Equilibrium Binding Studies on Interaction of Daunomycin with Deoxyribonucleic Acid, J. B. Chaires, N. Dattagupta and D. M. Crothers, *Biochemistry* **21**, 3933-3940 (1982).

121. Studies on Interaction of Anthracycline Antibiotics and Deoxyribonucleic Acid: Geometry of Intercalation of Iremycin and Daunomycin, H. Fritzsche, H. Triebel, J. B. Chaires, N. Dattagupta and D. M. Crothers, *Biochemistry* **21**, 3940-3946 (1982).

122. Orientation of Nucleosomes in the Thirty-Nanometer Chromatin Fiber. H. Yabuki, N. Dattagupta and D. M. Crothers, *Biochemistry* **21**, 5015-5020 (1982).

123. Bent Helical Structure in Kinetoplast DNA. J. C. Marini, S. D. Levene, D. M. Crothers and P. T. Englund, *Proc. Nat. Acad. Sci., U.S.A.* **79**, 7664-7668 (1982).

124. Nucleic Acid Aggregation Geometry and the Possible Evolutionary Origin of Ribosomes and the Genetic Code. D. M. Crothers, *J. Mol. Biol.* **162**, 379-391 (1982).

125. CAP and RNA Polymerase Interactions with the lac Promoter: Binding Stoichiometry and Long Range Effects. M. G. Fried & D. M. Crothers, *Nuc. Acids Res.* **11**, 141-157 (1983).

126. Binding of Daunomycin to Calf Thymus Nucleosomes. J. B. Chaires, N. Dattagupta and D. M. Crothers, *Biochemistry* **22**, 284-292 (1983).

127. CAP Binding to B and Z Forms of DNA. M. G. Fried, H.-M. Wu and D. M. Crothers, *Nuc. Acids Res.* **11**, 2479-2494 (1983).

128. Transmission of Long-range Effects in DNA. D. M. Crothers and M. Fried, *Cold Spring Harbor Symp. Quant. Biol.* **47**, 263-269 (1983).

129. A Bent Helix in Kinetoplast DNA. J. C. Marini, S. D. Levene, D. M. Crothers and P. T. Englund, *Cold Spring Harbor Symp. Quant. Biol.* **47**, 279-283 (1983).

130. High Resolution NMR Studies of A- and G-Containing Oligonucleotides. B. W.-K. Shum and D. M. Crothers, *Biopolymers* **22**, 919-933 (1983).

131. A Computer Graphics Study of Sequence-Directed Bending in DNA, S. D. Levene and D. M. Crothers, *J. Biomolec. Structure and Dynamics* **1**, 429-436 (1983).

132. DNA Bending and Protein-DNA Interactions, D. M. Crothers, S. D. Levene and H.-M. Wu, in "Nucleic Acids: The Vectors of Life," eds. B. Pullman and J. Jortner, *Jerusalem Symp. Quant. Chem. and Biochem.* **16**, 277-282 (1983).

133. A Characterization of the Low Temperature Structural Transition of E. coli 5S RNA by Partial Enzymatic Digestion, D. Rabin, T.-H. Kao and D. M. Crothers, *J. Biol. Chem.* **258**, 10,813-10,816 (1983).

134. Equilibrium Studies of the cAMP Receptor Protein-DNA Interaction, M. G. Fried and D. M. Crothers, *J. Mol. Biol.* **172**, 241-262 (1984).

135. Kinetics and Mechanism in the Reaction of Gene Regulatory Proteins with DNA, M. G. Fried and D. M. Crothers, *J. Mol. Biol.* **172**, 263-282 (1984).

136. Orientation of Nucleosomes and Linker DNA in Calf Thymus Chromatin Determined by Photochemical Dichroism, S. Mitra, D. Sen and D. M. Crothers, *Nature* **308**, 247-250 (1984).

137. The Locus of Sequence-Directed and Protein-Induced DNA Bending, H.-M. Wu and D. M. Crothers, *Nature* **308**, 509-513 (1984).

138. Relaxation Kinetics of DNA-Ligand Binding Including Direct Transfer, D. P. Ryan and D. M. Crothers, *Biopolymers* **23**, 537-562 (1984).

139. Kinetics of the Daunomycin-DNA Interaction, J. B. Chaires, N. Dattagupta and D. M. Crothers, *Biochemistry* **24**, 260-267 (1985).

140. Effects of DNA-Binding Drugs on Transcription, D. M. Crothers, D. R. Phillips and D. Straney, *Studia Biophysica* **104**, 21-24 (1985).

141. Intermediates in Transcription Initiation from the E. coli lac UV5 Promoter, D. C. Straney and D. M. Crothers, *Cell* **43**, 449-459 (1985).

142. Intermediates in Transcription Initiation and Propagation, D. C. Straney and D. M. Crothers, *Jerusalem Symp. Quant. Chem. and Biochem.* **18**, B. Pullman, P. O. P. Ts'o and E. L. Schneider, eds., 183-186 (1985).

143. Condensation of Chromatin: Role of Multivalent Cations, D. Sen and D. M. Crothers, *Biochemistry* **25**, 1495-1503 (1986).

144. Influence of DNA-Binding Drugs on Chromatin Condensation, D. Sen and D. M. Crothers, *Biochemistry* **25**, 1503-1509 (1986).

145. DNA Bending at Adenine.Thymine Tracts, H.-S. Koo, H.-M. Wu and D. M. Crothers, *Nature* **320**, 501-506 (1986).

146. Ring Closure Probabilities for DNA Fragments by Monte Carlo Simulation, S. D. Levene and D. M. Crothers, *J. Mol. Biol.* **189**, 61-72 (1986).

147. Topological Distributions and the Torsional Rigidity of DNA: A Monte Carlo Study of DNA Circles, S. D. Levene and D. M. Crothers, *J. Mol. Biol.* **189**, 73-83 (1986).

148. Higher Order Structure of Chromatin: Evidence from Photochemically Detected Linear Dichroism, D. Sen, S. Mitra and D. M. Crothers, *Biochemistry* **25**, 3441-3447 (1986).

149. Bending and Flexibility of Kinetoplast DNA, S. D. Levene, H.-M. Wu and D. M. Crothers, *Biochemistry* **25**, 3988-3995 (1986).

150. Kinetics and Sequence Specificity of Drug-DNA Interactions: An in vitro Transcription Assay, D. R. Phillips and D. M. Crothers, *Biochemistry* **25**, 7355-7362 (1986).

151. The DNA Binding Domain and Bending Angle of E. Coli CAP Protein, H.-N. Liu-Johnson, M. R. Gartenberg and D. M. Crothers, *Cell* **47**, 995-1005 (1986).

152. The Homeo Domain of a Murine Protein Binds 5' to its Own Homeo Box, A. Fainsod, L. D. Bogarad, T. Ruusala, M. Lubin, D. M. Crothers and F. R. Ruddle, *Proc. Natl. Acad. Sci., U.S.A.* **83**, 9532-9536 (1986).

153. Proton Nuclear Magnetic Resonance Studies on Bulge-Containing DNA Oligonucleotides from a Mutational Hot-Spot Sequence, S. A. Woodson and D. M. Crothers, *Biochemistry* **26**, 904-912 (1987).

154. Gel electrophoresis of Protein-DNA Complexes, D. M. Crothers, *Nature* **325**, 464-465 (1987).

155. A Stressed Intermediate in the Formation of Stably Initiated RNA Chains at the *E. coli* lac UV5 Promoter, D. C. Straney and D. M. Crothers, *J. Mol. Biol.* **193**, 267-278 (1987).

156. Comparison of the Open Complexes Formed by RNA Polymerase at the *E. coli* lac UV5 Promoter, D. C. Straney and D. M. Crothers, *J. Mol. Biol.* **193**, 279-292 (1987).

157. Anthracycline Antibiotics. Interaction with DNA and Nucleosomes and Inhibition of DNA Synthesis, H. Fritzsche, U. Wahnert, J. B. Chaires, N. Dattagupta, F. B. Schlessinger and D. M. Crothers, *Biochemistry* **26**, 1996-2000 (1987).

158. Effect of Drug-DNA Interactions upon Transcription Initiation at the lac Promoter, D. C. Straney and D. M. Crothers, *Biochemistry* **26**, 1987-1995 (1987).

159. Chemical Determinants of DNA Bending at Adenine-Thymine Tracts, H.-S. Koo and D. M. Crothers, *Biochemistry* **26**, 3745-3748 (1987).

160. Effects of Antitumor Drugs on Transcription, D. M. Crothers, D. C. Straney and D. R. Phillips in "Molecular Mechanisms of Carcinogenic and Antitumor Activity", C. Chagas and B. Pullman, eds, *Pontificiae Academiae Scientiarum Scripta Varia* **70**, 403-424 (1987).

161. Kinetics of the Stages of Transcription Initiation at the *Escherichia coli* lac UV5 Promoter, S. B. Straney and D. M. Crothers, *Biochemistry* **26**, 5063-5070 (1987).

162. DNA Bend Direction by Phase Sensitive Detection, S. S. Zinkel and D. M. Crothers, *Nature* **328**, 178-181 (1987).

163. Lac Repressor is a Transient Gene Activating Protein, S. B. Straney and D. M. Crothers, *Cell* **51**, 699-707 (1987).

164. Preferential Location of Bulged Guanosine Internal to a G·C Tract by ^{1}H NMR, S. A. Woodson and D. M. Crothers, *Biochemistry* **27**, 436-445 (1988).

165. Calibration of DNA Curvature and a Unified Description of Sequence-Directed DNA Bending, H.-S. Koo and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **85**, 1763-1767 (1988).

166. Structural Model for an Oligonucleotide Containing a Bulged Guanosine by NMR and Energy Minimization, S. A. Woodson and D. M. Crothers, *Biochemistry* **27**, 3130-3141 (1988).

167. The Major Adduct of the Antitumor Drug Cis-diamminedichloroplatinum(II) bends the duplex by ~40^o toward the Major Groove, J. A. Rice, D. M. Crothers, A. L. Pinto and S. J. Lippard, *Proc. Natl. Acad. Sci., USA* **85**, 4158-4161 (1988).

168. DNA Sequence Determinants of CAP-Induced Bending and Protein Binding Affinity, M. R. Gartenberg and D. M. Crothers, *Nature* **333**, 824-829 (1988).

169. Phased Psoralen Crosslinks Do Not Bend the DNA Double Helix, T. E. Haran and D. M. Crothers, *Biochemistry* **27**, 6967-6971 (1988).

170. Binding of 9-Aminoacridine to Bulged-Base DNA Oligomers from a Frame-Shift Hot Spot, S. A. Woodson and D. M. Crothers, *Biochemistry* **27**, 8904-8914 (1988).

171. Cooperativity in A-Tract Structure and Bending Properties of Composite T_nA_n Blocks, T. E. Haran and D. M. Crothers, *Biochemistry* **28**, 2763-2767.

172. Synergy Between Escherichia coli CAP Protein and RNA Polymerase in the lac Promoter Open Complex, D. C. Straney, S. B. Straney and D. M. Crothers, *J. Mol. Biol.* **206**, 41-57 (1989).

173. Nucleic Acid Hybridization: A Rapid Method for the Diagnosis of Infectious Diseases, N. Dattagupta, E. Huguenel, P. Rae and D. Crothers, *Perspectives in Antiinefective Therapy*,

Proceedings of an International Symposium held in Washington, D.C., August 31-September 3, 1988.

174. DNA Sequence Specificity of Mitomycin Cross-Linking, S. P. Teng, S. A. Woodson and D. M. Crothers, *Biochemistry* **28**, 3901-3907 (1989).

175. Modulation of Mitomycin Cross-Linking by DNA Bending in the Escherichia coli CAP Protein-DNA Complex, C. Cera and D. M. Crothers, *Biochemistry* **28**, 3908-3911 (1989).

176. Structural Basis for DNA Bending, J. G. Nadeau and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **86**, 2622-2626 (1989).

177. DNA Bending by the Bulge Defect, J. A. Rice and D. M. Crothers, *Biochemistry* **28**, 4512-4516 (1989).

178. DNA Cross-Linking by Intermediates in the Mitomycin Activation Cascade, C. Cera, M. Egbertson, S. P. Teng, D. M. Crothers and S. J. Danishefsky, *Biochemistry* **28**, 5665-5669 (1989).

179. Conformation of a Bulge-Containing Oligomer from a Hot-spot Sequence by NMR and Energy Minimization, S. A. Woodson and D. M. Crothers, *Biopolymers* **28**, 1149-1177 (1989).

180. Modulation of the Stability of a Gene-regulatory Protein Dimer by DNA and cAMP, A. M. Brown and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **86**, 7387-7391 (1989).

181. Artificial Nucleosome Positioning Sequences, T. E. Shrader and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **86**, 7418-7422 (1989).

182. Comparative Gel Electrophoresis Measurement of the DNA Bend Angle Induced by the Catabolite Activator Protein, S. S. Zinkel and D. M. Crothers, *Biopolymers* **29**, 29-38 (1990).

183. New Insight into Drug-DNA Interactions at Individual Drug Binding Sites Probed by RNA Polymerase During Active Transcription of the DNA, D. R. Phillips, R. J. White, H. Trist, C. Cullinane, D. Dean and D. M. Crothers, *Anti-Cancer Drug Design* **5**, 21-29 (1990).

184. Intrinsically Bent DNA, D. M. Crothers, T. E. Haran and J. G. Nadeau, *J. Biol. Chem.* **265**, 7093-7096 (1990).

185. Determination of the Extent of DNA Bending by an Adenine-Thymine Tract, H.-S. Koo, J. Drak, J. A. Rice and D. M. Crothers, *Biochemistry* **29**, 4227-4234 (1990).

186. N-methylmitomycin A Cross-Linking to Nucleosomal Structure, C. Cera, M. Palumbo, G. Palu and D. M. Crothers, *Anti-Cancer Drug Design* **5**, 55-58 (1990).

187. Monte-Carlo Simulation of Multisite Echinomycin-DNA Interactions Detected by in Vitro Transcription Analysis, D. R. Phillips, R. J. White, D. Dean and D. M. Crothers, *Biochemistry* **29**, 4812-4819 (1990).

188. Molecular Characterization of the GCN4-DNA Complex, M. R. Gartenberg, C. Ampe, T. A. Steitz and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **87**, 6034-6038 (1990).

189. Fragments of the HIV-1 Tat Protein Specifically Bind TAR RNA, K. M. Weeks, C. Ampe, S. C. Schultz, T. A. Steitz and D. M. Crothers, *Science* **249**, 1281-1285 (1990).

190. Effects of DNA Sequence and Histone-Histone Interactions on Nucleosome Placement, T. E. Shrader and D. M. Crothers, *J. Mol. Biol.* **216**, 69-84 (1990).

191. Sequence-dependent Contribution of Distal Binding Domains to CAP Protein-DNA Binding Affinity, D. D. Dalma-Weiszhausz, M. R. Gartenberg and D. M. Crothers, *Nucl. Acid Res.* **19**, 611-616 (1991).

192. Rapid High-Performance Liquid Chromatography of Nucleic Acids with Polystyrene-based Micropellicular Anion Exchangers, Y. F. Maa, S. C. Lin, C. Horvath, U. C. Yang and D. M. Crothers, *J. Chromatogr.* **508**, 61-73 (1990).

193. Helical Repeat and Chirality Effects on DNA Gel Electrophoretic Mobility, J. Drak and D. M. Crothers, *Proc. Natl. Acad. Sci., USA* **88**, 3074-3078 (1991).

194. Catabolite Activator Protein-Induced DNA Bending in Transcription Initiation, S. S. Zinkel and D. M. Crothers, *J. Mol.Biol.* **219**, 201-205 (1991).

195. Synthetic DNA Bending Sequences Increase the Rate of *in Vitro* Transcription Initiation at the *Escherichia coli lac* Promoter, M. R. Gartenberg and D. M. Crothers, *J. Mol. Biol.* **219**, 217-230 (1991).

196. RNA Recognition by Tat-Derived Peptides: Interaction in the Major Groove?, K. M. Weeks and D. M. Crothers, *Cell* **66**, 577-588 (1991).

197. The Carbohydrate Domain of Calicheamicin γ_1^I Determines its Sequence Specificity for DNA Cleavage, J. Drak, N. Iwasawa, S. Danishefsky and D. M. Crothers, *Proc. Natl. Acad. Sci. USA* **88**, 7464-7468.

198. Specificity and Stringency in DNA Triplex Formation, R. W. Roberts and D. M. Crothers, *Proc. Natl. Acad. Sci. USA* **88**, 9397-9401 (1991).

199. DNA Bending in Protein-DNA Complexes, D. M. Crothers, M. R. Gartenberg and T. E. Shrader, *Methods in Enzymology* **208**, 118-146 (1991).

200. Sliding and Intermolecular Transfer of the *lac* repressor: Kinetic Perturbation of a Reaction Intermediate by a Distant Sequence, T. Ruusala and D. M. Crothers, *Proc. Natl. Acad. Sci. USA* **89**, 4903-4907 (1992).

201. Protein-induced Bending and DNA Cyclization, J. D. Kahn and D. M. Crothers, *Proc. Natl. Acad. Sci. USA* **89**, 6343-6347 (1992).

202. DNA Bending, Flexibility, and Helical Repeat by Cyclization Kinetics, D. M. Crothers, J. Drak, J. D. Kahn and S. D. Levene, *Methods in Enzymology* **212B**, 3-29 (1992).

203. Global Features of DNA Structures by Comparative Gel Electrophoresis, D. M. Crothers and J. Drak, *Methods in Enzymology* **212B**, 46-71 (1992).

204. RNA Binding Assays for the Tat-Derived Peptides: Implications for Specificity, K.M. Weeks and D. M. Crothers, *Biochemistry* **31**, 10281-10287 (1992).

205. Interaction of the Aryl Tetrasaccharide Domain of Calicheamicin γ_I^1 with DNA: Influence of Aglycon and Methidiumproply-EDTA·Iron(II)-Mediated DNA Cleavage, J. Aiyar, S.J. Danishefsky and D.M. Crothers, *J. Am. Chem. Soc.* **114**, 7552-7554 (1992).

206. Structural Modifications of Camptothecin and Effects on Topoisomerase Inhibition, R.T. Crow and D.M. Crothers, *J. Med. Chem.* **35**, 4160-4164 (1992).

207. Stability and Properties of Double and Triple Helices: Dramatic Effects of RNA or DNA Backbone Composition, R.W. Roberts and D.M. Crothers, *Science* **258**, 1463-1466 (1992).

208. Transcriptional Activation by *Escherichia coli* CAP Protein, D.M. Crothers and T.A. Steitz, in *Transcriptional Regulation*, S. McKnight and K. Yamamoto, eds., Cold Spring Harbor Laboratory Press (1992).

209. DNA Bends and Bendability, D.M. Crothers, in *Molecular Structure and Life: Molecular Recognition of Nucleic Acids*, Y. Kyogoky and Y. Nishimura, eds., CRC Press, Boca Raton, FL (1992).

210. The *Leptomonas collosoma* Spliced Leader RNA Can Switch between Two Alternate Structural Forms, K.A. LeCuyer and D.M. Crothers, *Biochemistry* **32**, 5301-5311 (1993).

211. Major Groove Accessibility of RNA, K.M. Weeks and D.M. Crothers, *Science* **261**, 1574-1577 (1993).

212. RNA Targeting by the HIV-1 Tat Protein, K.M. Weeks and D.M. Crothers, *Perspectives in Drug Discovery and Design* **1**, 225-234 (1993).

213. Architectural Elements in Nucleoprotein Complexes, D. M. Crothers, *Current Biology* **3**, 675-676 (1993).

214. Site selectivity of Daunomycin, C. J. Roche, J. A. Thomson and D. M. Crothers, *Biochemistry* **33**, 926-935 (1994).

215. Binding Affinity and Site Selectivity of Daunomycin Analogues, C. J. Roche, D. Berkowitz, G. A. Sulikowski, S. J. Danishefsky and D. M. Crothers, *Biochemistry* **33**, 936-942 (1994).

216. Detection of Localized DNA Flexibility, J. D. Kahn, E. Yun and D. M. Crothers, *Nature* **368**, 163-166 (1994).

217. Correlation of Adenine H2/H8 Resonances in Uniformly Labeled RNAs by 2D HCCH-TOCSY: A New tool for ^{1}H Assignment, J. P. Marino, J. H. Prestegard and D. M. Crothers, *J. Am. Chem. Soc.* **116**, 2205-2206 (1994).

218. Kinetics of an RNA Conformational Switch, K. A. LeCuyer and D. M. Crothers, *Proc. Natl. Acad. Sci. USA* **91**, 3373-3377 (1994).

219. DNA Bends and Bendability, D. M. Crothers, *The Robert A. Welch Foundation 37th Conference on Chemical Research. 40 Years of the Double Helix* (1993).

220. DNA Bending in Transcription Initiation, J. D. Kahn and D. M. Crothers, *Cold Spring Harbor Symposium on Quantitative Biology,* **LVIII**, 115 - 122 (1993).

221. A Three-Dimensional Triple-Resonance ^{1}H, ^{13}C, ^{31}P Experiment: Sequential Through-Bond Correlation of Ribose Protons and Intervening Phosphorous along the RNA Oligonucleotide Backbone, J. P. Marino, H. Schwalbe, C. Anklin, W. Bermel, D. M. Crothers, and C. Griesinger, *J. Am. Chem. Soc.* **116**, 6472 - 6473 (1994).

222. On the DNA Recognition Role of the Carbohydrate Sector in Calicheamicin: A Comparison of DNA Cleaving Capacity of Enantiomeric Calicheamicinones, J. Aiyar, S. A. Hitchcock, D. Denhart, K. K. C. Liu, S. J. Danishefsky, and D. M. Crothers, *Angew. Chem. Int. Ed. Engl.* **33**, 855-858 (1994).

223. Inhibition of Topoisomerase I by Anthracycline Antibiotics: Evidence for General Inhibition of Topoisomerase I by DNA-Binding Agents. R. T. Crow and D. M. Crothers, *J. Med. Chem.* **37**, 3191-3194 (1994).

224. Sequence Elements Responsible for DNA Curvature. T. E. Haran, J. D. Kahn and D. M. Crothers, *J. Mol. Biol.* **244**, 135-144 (1994).

225. Perspective: Upsetting the Balance of Forces in DNA, D. M. Crothers, *Science* **266,** 1819-1820 (1994).

226. An In Vitro Transcription Assay for Probing Drug-DNA Interactions During Active Transcription of DNA, D. R. Phillips and D. M. Crothers, *Methods in Molecular Biol.* **37**, 89-105 (1995).

227. Sequential Correlation of Anomeric Ribose Protons and Intervening Phosphorous in RNA Oligonucleotides by a $^{1}H,^{13}C,^{31}P$ Triple Resonance Experiment: HCP-CCH-TOCSY, J. P. Marino, H. Schwalbe, C. Anklin, W. Bermel, D. M. Crothers, and C. Griesinger, *J. Biomolecular NMR* **5**, 87-92 (1995).

228. NMR of Enzymatically Synthesized Uniformly $^{13}C^{15}N$-labeled DNA Oligonucleotides, D. P. Zimmer and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **92** 3091-3095 (1995).

229. Determinants of RNA Hairpin Loop-Loop Complex Stability, R. S. Gregorian and D. M. Crothers, *J. Mol. Biol.* **248**, 968-984 (1995).

230. Bent Helix Formation Between RNA Hairpins with Complementary Loops, J. P. Marino, R. S. Gregorian, G. Csankovszki and D. M. Crothers, *Science* **268**, 1448-1454 (1995).

231. Interaction of Human Immunodeficiency Virus Type 1 Tat-Derived Peptides with TAR RNA, K. S. Long and D. M. Crothers, *Biochemistry* **34**, 8885-8895 (1995).

232. In Vivo Structural Analysis of Spliced Leader RNAs in *Trypanosoma brucei* and *Leptomonas collosoma*: A Flexible Structure that Is Independent of Cap4 Methylations, K. A. Harris, Jr., D. M. Crothers and E. Ullu, *RNA* **1**, 351-362 (1995).

233. Determining RNA Solution Structure by Segmental Isotopic Labeling and NMR: Applications to *Caenorhabditis elegans* Spliced Leader RNA 1, J. Xu, J. Lapham and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 44-48 (1996).

234. Fos and Jun Do Not Bend the AP-1 Recognition Site, A. Sitlani and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 3248-3252 (1996).

235. RNase H Cleavage for Processing of In Vitro Transcribed RNA for NMR Studies and RNA Ligation, J. Lapham and D. M. Crothers, *RNA* **2**, 289-296 (1996).

236. Prediction of the Stability of DNA Triplexes, R. W. Roberts and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **93**, 4329-4325 (1996).

237. Kinetic Discrimination in the Folding of Intramolecular Triple Helices, R. W. Roberts and D. M. Crothers, *J. Mol. Biol.* **260**, 135-146 (1996).

238. Synthesis and Preliminary DNA Binding Study of Hybrids of the Carbohydrate Domain of Calicheamicin γ_1^I and the Aglycone of Daunorubicin: Calichearubicins A and B, K. M. Depew, S. M. Zeman, S. H. Boyer, D. J. Denhart, N. Ikemoto, S. J. Danishefsky and D. M. Crothers, *Angew. Chem. Int. Ed. Engl.* **35**, 2797 - 2801 (1996).

239. Identification and Characterization of Genomic Nucleosome-positioning Sequences, H. R. Widlund, H. Cao, S. Simonsson, E. Magnusson, T. Simonsson. P. E. Nielsen, J. D. Kahn, D. M. Crothers and M. Kubista, *J. Mol. Biol.* **267**, 807-818 (1997).

240. The Position of Site-Directed Cleavage of RNA using RNase H and 2'-O-methyl Oligonucleotides is Dependent on the Enzyme Source, J. Lapham, Y.-T. Yu, M.-D. Shu, J. A. Steitz, and D. M. Crothers, *RNA* **3**, 950-951 (1997).

241. Measurement of Diffusion Constants for Nucleic Acids by NMR, J. Lapham, J. P. Rife, P. B. Moore, and D. M. Crothers, *J. Biomolec. NMR* **10**, 255-262 (1997).

242. DNA-Binding Domains of Fos and Jun Do Not Induce DNA Curvature: An Investigation with Solution and Gel Methods, A. Sitlani and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 1404-1409 (1998).

243. Characterization of the ATF /CREB Site and Its Complex with GCN4, S. C. Hockings, J. D. Kahn, and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 1410-1415 (1998).

244. Measurement of the DNA Bend Angle Induced by the Catabolite Activator Protein Using Monte Carlo Simulation of Cyclization Kinetics, J. D. Kahn and D. M. Crothers, *J. Mol. Biol.* **276**, 287-309 (1998).

245. Simultaneous Determination of Helical Unwinding Angles and Intrinsic Association Constants in Ligand-DNA Complexes: The Interaction between DNA and Calichearubicin B, S. M. Zeman, K. M. Depew, S. J. Danishefsky and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 4327-4332 (1998).

246. The Solution Structure of an RNA Loop-Loop Complex: The *ColE1* Inverted Loop Sequence, A. J. Lee and D. M. Crothers, *Structure* **6**, 993-1005 (1998).

247. Characterization of Covalent Adriamycin-DNA Adducts, S. M. Zeman, D. R. Phillips and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 11561-11565 (1998).

248. An *In Vitro* Transcription Assay for Probing Drug-DNA Interactions at Individual Drug Sites, D. R. Phillips, C. M. Cullinane and D. M. Crothers, *Molecular Biotechnology* **10**, 63-75 (1998).

249. DNA Curvature and Deformation in Protein-DNA Complexes: A Step in the Right Direction (Commentary), D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **95**, 15163-15165 (1998).

250. Decreased Imino Proton Exchange and Base-pair Opening in the IHF-DNA Complex Measured by NMR, G. M. Dhavan, J. Lapham, S. Yang and D. M. Crothers, *J. Mol. Biol.* **288**, 659-671 (1999).

251. Characterization of the Solution Conformations of Unbound and Tat Peptide-Bound Forms of HIV-1 TAR RNA, K. S. Long and D. M. Crothers, *Biochemistry* **38**, 10059-10069 (1999).

252. Interaction of Calicheamicin γ_1^I and its Related Carbohydrates with DNA-Protein Complexes, C. Sissi, J. Aiyar, S. Boyer, K. Depew, S. Danishefsky and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **96**, 10643-10648 (1999).

253. DNA Bending by Adenine-Thymine Tracts, D. M. Crothers and Z. Shakked, *Oxford Handbook of Nucleic Acid Structures*, Ed. S. Neidle, Oxford University Press, Oxford (1999).

254. Site-Specific Cleavage of Transcript RNA, J. Lapham and D. M. Crothers, *Methods in Enzymology* **317**, 132-139 (2000).

255. On the Kinetics of Distamycin Binding to its Target Sites on Duplex DNA, R. Baliga and D. M. Crothers, *Proc. Natl. Acad. Sci. U.S.A.* **97**, 7814-7818 (2000).